Amendments to the Specification:

Please cancel the heading before the title.

~~DESCRIPTION~~

Please cancel the heading before paragraph **[0001]**.

~~Technical Field~~

Please cancel the heading before paragraph **[0002]**.

~~Background Art~~

Please cancel the headings before paragraph **[0005]**.

~~Disclosure of the Invention~~

~~Problems to be Solved by the Invention~~

Please replace paragraph **[0010]** with the following rewritten paragraph:

[0010] In view of these points, it is a first object of the present invention to provide an exposure technology which can efficiently control a rotationally asymmetric component or a high order component among the imaging characteristics when the light quantity distribution of an exposure beam passing through at least a part of one of a projection optical system and a mask is rotationally asymmetric or it varies in a radial direction significantly.

Furthermore, it is a second objective of the present invention to provide an exposure technology and a device production technology capable of suppressing variations in the imaging characteristic in such a case.

Please cancel the heading before paragraph **[0011]** and replace paragraph **[0011]** with the following rewritten paragraph:

~~Means to Solve the Problems~~

[0011] In a first exposure method according to the present invention, a first object (11) is illuminated with an exposure beam (IL), and with this exposure beam a second object (18) is exposed through the first object and a projection optical system (14), wherein at least a

part (32) of one of the first object and the projection optical system is irradiated with a light beam (LBA, LBB) having a wavelength range different from that of the exposure beam through a space waveguide mechanism (44A, 44B), to correct an imaging characteristic of the projection optical system.

Please replace paragraph **[0014]** with the following rewritten paragraph:

[0014] In a second exposure method according to the present invention, a first object (11) is illuminated with an exposure beam (IL), and with the exposure beam a second object (18) is exposed through the first object and a projection optical system (14), wherein at least a part (32) of one of the first object and the projection optical system is irradiated with a light beam (LBA, LBB) having a wavelength range different from that of the exposure beam and being in a predetermined polarization state through a polarization state control mechanism (51A, 51B), to correct an imaging characteristic of the projection optical system.

Please replace paragraph **[0016]** with the following rewritten paragraph:

[0016] In a third exposure method according to the present invention, the first object (11) is illuminated with the exposure beam (IL), and with this exposure beam the second object (18) is exposed through the first object and the projection optical system (14), wherein at least a part of one of the first object and the projection optical system is irradiated with a light beam (LBA, LBB) having a wavelength range different from the exposure beam and being in a predetermined polarization state through an optical guide (72A, 72B, 75B) and a polarization state control mechanism (74A, 74B), to correct an imaging characteristic of the projection optical system.

Please replace paragraph **[0019]** with the following rewritten paragraph:

[0019] Moreover, when the at least the part of one of the first object and the projection optical system is illuminated with the exposure beam in a rotationally asymmetric light-quantity distribution, the light beam may be applied so as to correct a rotationally

asymmetric aberration of the projection optical system generated by the irradiation of the exposure beam. This allows the rotationally asymmetric aberration to be suppressed.

Moreover, a generated amount of the rotationally asymmetric aberration may be calculated based on an irradiation amount of the exposure beam, and the light beam may be applied based on this calculation result. This allows the irradiation amount of the light beam to be controlled.

Please replace paragraph **[0020]** with the following rewritten paragraph:

[0020] Moreover, a device production method according to the present invention includes a lithography process, and in this lithography process a pattern (11) is transferred onto a photosensitive element (18) using the exposure method of the present invention. Application of the present invention allows the imaging characteristic in using a dipole illumination and a small σ illumination to be improved, and therefore, devices can be produced with high precision.

Next, in a first exposure apparatus according to the present invention, a first object (11) on which a pattern for transfer is formed is illuminated with an exposure beam, and with the exposure beam a second object (18) is exposed through the first object and a projection optical system (14), wherein the exposure apparatus comprises an irradiation mechanism which irradiates at least a part (32) of <u>one of </u>the first object and the projection optical system with a light beam (LBA, LBB) having a wavelength range different from that of the exposure beam, and wherein the irradiation mechanism includes a space waveguide mechanism (44A, 44B) for guiding the light beam along a predetermined optical path.

Please replace paragraph **[0022]** with the following rewritten paragraph:

[0022] Moreover, in a second exposure apparatus according to the present invention, a first object (11) on which a pattern for transfer is formed is illuminated with an exposure beam, and with the exposure beam a second object (18) is exposed through the first

object and a projection optical system (14), wherein the exposure apparatus comprises an irradiation mechanism which irradiates at least a part (32) of one of the first object and the projection optical system with a light beam (LBA, LBB) having a wavelength range different from that of the exposure beam, and wherein the irradiation mechanism includes a polarization state control mechanism (51A, 51B) which sets a polarization state of the light beam to a predetermined state.

Please replace paragraph **[0024]** with the following rewritten paragraph:

[0024] Next, in a third exposure apparatus according to the present invention, a first object (11) in which a pattern for transfer is formed is illuminated with an exposure beam, and with the exposure beam a second object (18) is exposed through the first object and a projection optical system (14), wherein the exposure apparatus comprises an irradiation mechanism which irradiates at least a part (32) of one of the first object and the projection optical system with a light beam (LBA, LBB) having a wavelength range different from that of the exposure beam, and wherein the irradiation mechanism includes an optical guide (72A, 72B, 75B) which guides the light beam from a light source (411A, 411B, 411) for generating the light beam, and a polarization state control mechanism (74A, 74B) which sets the polarization state of the light beams emitted from the optical guide to a predetermined state.

Please replace paragraph **[0029]** with the following rewritten paragraph:

[0029] Moreover, when the at least the part of one of the first object and the projection optical system is illuminated in a rotationally asymmetric light-quantity distribution with the exposure beam, the irradiation mechanism may ~~applies~~ apply the light beam so as to correct a rotationally asymmetric aberration of the projection optical system generated by the illumination of the exposure beam. This allows the rotationally asymmetric aberration to be corrected.

Moreover, the exposure apparatus may further comprise an aberration correction mechanism (16) which corrects the rotationally symmetric aberration of the projection optical system, and a control unit (24) which controls operations of the irradiation mechanism and aberration correction mechanism to correct an aberration of the projection optical system. The aberration which cannot be corrected by the aberration correction mechanism can be corrected by the irradiation mechanism.

Please cancel the heading before paragraph **[0031]**.

~~Effect of the Invention~~

Please replace the heading before paragraph **[0032]** with the following rewritten heading and replace paragraph **[0032]** with the following rewritten paragraph:

~~Brief Description of the Figures in the Drawings~~

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Fig. 1 is a partially cut-out view showing a schematic configuration of a projection exposure apparatus of a first embodiment of the present invention.

Fig. 2 is a partially cut-out view showing an example of the configuration of an imaging characteristic correction mechanism 16 in Fig. 1.

~~Fig. 3(A)~~ Fig. 3A is a view showing an L&S pattern in an X direction, and ~~Fig. 3(B)~~ Fig. 3B is a view showing a light quantity distribution on a pupil plane of the projection optical system at the time of a dipole illumination in the X direction.

~~Fig. 4(A)~~ Fig. 4A is a view showing an L&S pattern in a Y direction, and ~~Fig. 4(B)~~ Fig. 4B is a view showing a light quantity distribution on the pupil plane of the projection optical system at the time of a dipole illumination in the Y direction.

Fig. 5 is a view showing a temperature distribution of a lens at the time of a dipole illumination in the X direction.

Fig. 6 is a view showing a configuration of a correcting light irradiation mechanism 40 of the first embodiment of the present invention.

Fig. 7 is a plan view of a projection optical system 14 cut out along waveguides 44A and 44B of Fig. 6.

Fig. 8 is a plan view showing an irradiation area of an exposure light and a correcting light with respect to a lens at the time of a dipole illumination in the X direction in the first embodiment of the present invention.

Fig. 9 is a view showing a modification example of the correcting light irradiation mechanism 40 of the first embodiment.

Fig. 10 is a view showing a configuration of a correcting light irradiation mechanism 40A of a second embodiment of the present invention.

Fig. 11 is a view showing a modification example of the correcting light irradiation mechanism 40A of the second embodiment.

Fig. 12 is a view showing a configuration of a correcting light irradiation mechanism 40B of a third embodiment of the present invention.

Fig. 13 is a view showing a modification example of the correcting light irradiation mechanism 40B of the third embodiment.

Fig. 14 is a view showing an example of the configuration of a variable attenuator 54A in Fig. 10.

Please cancel paragraph **[0033]** and the heading "Description of the Symbols" directly before paragraph **[0033]**.

~~Description of the Symbols~~

~~[0033] 1: Exposure light source, ILS: Illumination optical system, 11: Reticle, 14: Projection optical system, 16: Imaging characteristic correction mechanism, 18: Wafer, 20: Wafer stage, 24: Main control system, 25: Illumination system aperture stop member, 32:~~

~~Lens, 40, 40A, 40B: Correcting light irradiation mechanism, 412, 412A and 412 B: CO_2 Laser, 43, 43A, 43B: Photodetector, 44A, 44B, 44C, 44D: Waveguide, 45A, 45B, 45C, 45D: Irradiation unit, 51A, 51B: 1/4 Phase plate, 53A, 53B: Photodetector, 54A, 54B: Variable attenuator, 57A, 57B: Variable mirror, 72A, 72B, 75B: Hollow fiber, 74A, 74B: Polarization plate~~

Please cancel the heading before paragraph **[0034]**.

~~Best Mode for Carrying out the Invention~~

Please replace paragraph **[0050]** with the following rewritten paragraph:

[0050] Now, in this example, in order to carry out a dipole illumination, in the pupil plane of the illumination optical system ILS of Fig. 1 there is disposed the aperture stop 26A having two openings spaced apart in the direction corresponding to the X direction. In this case, the main pattern for transfer formed in the reticle 11 is a line-and-space pattern (hereinafter, referred ~~to as a~~ to as an "L&S pattern") in the X direction 33V, as enlargedly shown in ~~Fig. 3(A)~~ Fig. 3A as an example, wherein long and slender line patterns in the Y direction are arrayed in the X direction (non-scanning direction) with a pitch almost close to the resolution limit of the projection optical system 14. In this case, usually there are also formed on the reticle 11 another plurality of L&S patterns or the like having the array directions of the X direction and the Y direction (scanning direction) at an array pitch larger than that of the L&S pattern 33V.

Please replace paragraph **[0051]** with the following rewritten paragraph:

[0051] Like in this example, in a dipole illumination in the X direction using the aperture stop 26A, assuming that no reticle is present, as shown in ~~Fig. 3(B),~~ Fig. 3B, in the pupil plane PP of the projection optical system 14, two circular areas 34, which are symmetrical in the X direction across the optical axis AX, are illuminated with the exposure light IL. Moreover, also in the case where various reticle patterns are disposed in the optical

path of the exposure light IL, because usually the light quantity of the 0th order light is quite large as compared with the light quantity of the diffracted light and the diffraction angle is also small, the majority of the exposure light IL (imaging light flux) passes through the circular area 34 or the vicinity thereof. Moreover, when the reticle 11 of ~~Fig. 3(A)~~ Fig. 3A is disposed in the optical path of the exposure light IL like in this example, ± 1st order diffracted lights from the L&S pattern 33V with a pitch close to the resolution limit also pass through the almost circular area 34 or the vicinity thereof, and therefore, the image of the L&S pattern 33V can be projected onto the wafer at high resolution.

Please replace paragraph **[0052]** with the following rewritten paragraph:

[0052] Under this condition, the light quantity distribution of the exposure light IL, which enters the lens 32 in the vicinity of the pupil plane PP of the projection optical system 14 of Fig. 1, is also nearly equal to the light quantity distribution of ~~Fig. 3(B).~~ Fig. 3B. Therefore, if the exposure is continued, the temperature distribution of the lens 32 in the vicinity of the pupil plane PP becomes such that the temperature is the highest in two circular areas 34A, which sandwich the optical axis in the X direction, and it ~~decrease~~ decreases gradually toward a peripheral area 34B thereof, as shown in Fig. 5, and in response to the temperature distribution the lens 32 thermally expands (deforms by heat) and the refractive index distribution also varies. As a result, the refractive power increases with respect to the light beam opened in the Y direction in the lens 32, while the refractive power decreases with respect to the light beam opened in the X direction. For this reason, the center astigmatism ΔZ which is an astigmatic aberration on the optical axis is generated. This center astigmatism ΔZ increases gradually with time and is saturated at a predetermined value. This is because the temperature of the lens 32 is saturated.

Please replace paragraph **[0053]** with the following rewritten paragraph:

[0053] Under this condition, if there is formed on the reticle 11 an L&S pattern arrayed at a predetermined pitch in the Y direction other than the L&S pattern 33V in the X direction, and if the image plane of the L&S pattern 33V in the X direction is focused with respect to the wafer plane, then a blur due to defocus arises in the image of the L&S pattern in the Y direction.

On the other hand, as enlargedly shown in Fig. 4(A), assume that there is formed an L&S pattern 33H in the Y direction, wherein line patterns which are long and slender mainly in the X direction on the reticle 11 are arrayed in the Y direction (scanning direction) at a pitch almost close to the resolution limit of the projection optical system 14. In this case, in the pupil plane of the illumination optical system ILS of Fig. 1, the aperture stop 26B in a form of the aperture stop 26A rotated by 90° is set. In a dipole illumination in the Y direction using the aperture stop 26B, assuming that no reticle is present, as shown in ~~Fig. 4(B),~~ Fig. 4B, in the pupil plane PP of the projection optical system 14 two circular areas 35 which are symmetrical in the Y direction across the optical axis AX are illuminated with the exposure light IL. In this case, even if various reticle patterns are disposed in the optical path of the exposure light IL, the majority of the exposure light IL (imaging light flux) usually passes through the circular area 35 and the vicinity thereof. Moreover, if the reticle 11 of ~~Fig. 4(A)~~ Fig. 4A is disposed in the optical path of the exposure light IL, ± 1st order diffracted lights from the L&S pattern 33H with a pitch close to the resolution limit also pass through the almost circular area 35 or the vicinity thereof, and therefore, the image of the L&S pattern 33H can be projected onto the wafer at high resolution.

Please replace paragraph **[0054]** with the following rewritten paragraph:

[0054] In this case, the light quantity distribution of the exposure light IL which enters the lens 32 in the vicinity of the pupil plane PP of the projection optical system 14 of Fig. 1 is also nearly equal to the light quantity distribution of ~~Fig. 4(B).~~ Fig. 4B. Therefore, if

the exposure is continued, the temperature distribution in the lens 32 becomes that of the distribution of Fig. 5 rotated by almost 90°, and in the projection optical system 14 the center astigmatism will generate, which has the opposite sign and almost the same magnitude as in the case of using the dipole illumination of ~~Fig. 3(B).~~ Fig. 3B. In addition, in this embodiment, because the reticle 11 is illuminated in a rectangular illumination area with the X direction (non-scanning direction) being the longitudinal direction, the center astigmatism originating from this illumination area also always arises slightly with the same sign as in the case of using the dipole illumination of ~~Fig. 3(B).~~ Fig. 3B. On the other hand, as for the center astigmatism which arises in the dipole illumination of ~~Fig. 4(B),~~ Fig. 4B, the sign becomes opposite to that of the center astigmatism originating from the rectangular illumination area, and the center astigmatism as a whole becomes slightly smaller than the case of using the dipole illumination of ~~Fig. 3(B).~~ Fig. 3B.

Please replace paragraph **[0069]** with the following rewritten paragraph:

[0069] Moreover, in order to carry out aberration correction with higher precision, other configuration may be possible so that the correcting light may irradiate the lens 32 selectively in eight or more areas with an almost equiangular interval about the optical axis AX, for example.

[Method for irradiating a correcting light under a rotationally asymmetric illumination condition, or the like]

Next, with respect to a method for irradiating a correcting light under a rotationally asymmetric illumination condition, the case where the center astigmatism which arises in a dipole illumination is corrected is described as an example. Because in this embodiment a dipole illumination in the X direction is carried out, as shown in ~~Fig. 3(B)~~ Fig. 3B the exposure light IL illuminates two circular areas 34 which sandwich the optical axis AX in the X direction on the pupil plane PP of the projection optical system 14.

Please cancel the heading before paragraph **[0102]**.

~~Industrial Applicability~~

Please replace the Abstract with the attached substitute Abstract.